Title: The systematics and molecular ecology of agriculturally important fungi

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Abstract:
Fungi are ubiquitous in agroecosystems and have a broad range of impacts on plant health and agricultural productivity. Fungal pathogens diminish crop yields, resulting in economic losses and food insecurity. Other fungi may promote plant health by protecting them from attack by pathogens or pest organisms. Advances in evolutionary analysis, in conjunction with the ability to develop large molecular data sets up to and including entire genomes, now enable unprecedented insight into the genetic histories and genetic structure of many agriculturally significant fungi. One especially significant finding to emerge is that many traditionally recognized species are in fact species complexes, with newly discovered species often having distinct biologies relevant to their ecological roles and agriculture impacts. I will present findings of phylogenetic studies of two ubiquitous fungi: (i) *Colletotrichum gloeosporioides*, a plant-associated species that causes anthracnose disease, fruit rots and asymptomatic endophytes and (ii) *Beauveria bassiana*, an insect pathogen that is used in the biological control of pest insects. Our studies have shown that both morphological species encompass significant species radiations. In the *C. gloeosporioides* complex, we have discovered multiple phylogenetic species characterized by distinct ecologies either as host-specific pathogens or as weak, wide-host range pathogens/fruit rots and asymptomatic endophytes. Significantly, none of these are the actual *C. gloeosporioides* of Europe, a result important to plant quarantine and disease management strategies. *Beauveria bassiana* includes over 20 phylogenetic species, many with global distributions. Although asexually reproducing, phylogenetic evidence links *B. bassiana* to the sexual ascomycete *Cordyceps*. Although sexual reproduction is exceptionally infrequent, the majority of phylogenetic species are sexually competent because they possess genes that define mating type, which are essential to mating and sexual development. Mycotrol™, the principal *B. bassiana* insect biocontrol agent is shown to belong to a relatively rare species; however, its application has increased its range to several continents. The shift to molecular methods for the characterization of fungi, provide robust, objective tools to detect, identify and assess diversity. Coupled with web-accessible diagnostic databases, identification of agriculturally important species can now be achieved by diverse biologists that have the ability to generate basic sequence and marker data.